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Sir:

Transmitted herewith for filing is the patent application of

Inventors: **Kari Jyrkkä**
Pekka Möttönen

For: **ENHANCEMENTS TO THE 3-CARRIER COMPACT SOLUTION FOR IS-136HS**

Enclosed are:

- Declaration and Power of Attorney and an Associate Power of Attorney;
- X 12 pages of Specification, 2 pages Claims, 1 page of Abstract; and 8 pages of Appendix A;
- X 2 sheet of drawings;
- An Assignment of the invention to: **Nokia Mobile Phones Limited, Espoo, FINLAND**, will follow;
- Information Disclosure Statement (and Form PTO-1449 with copies of cited documents);
- X Priority of Provisional Application No. **60/136,494**, filed on **May 28, 1999** is herewith claimed under 35 U.S.C. §119(e).

The Filing Fee (large entity) is calculated below.

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CLAIMS AS FILED

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5 872.8708 USU
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Pekka Möttönen

**ENHANCEMENTS TO THE 3-CARRIER COMPACT
SOLUTION FOR IS-136HS**

10 **CLAIM OF PRIORITY FROM A COPENDING PROVISIONAL PATENT
APPLICATION:**

Priority is herewith claimed under 35 U.S.C. §119(e) from
copending Provisional Patent Application No.: 60/136,494,
filed 05/28/99, entitled "ENHANCEMENTS TO THE 3-CARRIER
15 COMPACT SOLUTION FOR IS-136HS", by Kari Jyrkkä and Pekka
Möttönen. The disclosure of this Provisional Patent
Application is incorporated by reference herein in its
entirety.

FIELD OF THE INVENTION:

20 This invention relates generally to wireless communication
systems and terminals and, in particular, to the
integration of various types of wireless communication
networks having differing channel width, spacing and
bandwidth requirements. With even greater specificity, the
25 teachings of this invention relate to a narrowband
deployment of a Global System for Mobile Communications
(GSM)-based network.

BACKGROUND OF THE INVENTION:

As an example of a narrowband deployment with a GSM-based
30 network, a proposed standard for IS-136HS integrates 200kHz

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GSM-like carriers with the current IS-136 TDMA system, with a 1MHz initial deployment. General reference to GSM carriers, networks and mobile stations can be had by referring to "The GSM System for Mobile Communications", by Michel Mouly and Marie-Bernadette Pautet, 1992, the disclosure of which is incorporated by reference in its entirety.

One attractive solution would be to use the nearly completed specification, at the time of filing of the Provisional Patent Application, for Enhanced General Packet Radio Services, or EGPRS having 8-PSK modulation plus General Packet Radio Services (GPRS) packet data channels, from GSM/ETSI. This would save a considerable amount of specification work by adapting the work already done for the GSM 200kHz carrier. However, at least some network operators have expressed a preference to make the initial 200kHz deployment using a very narrow bandwidth (1MHz), whereas currently used GSM systems require at least 2.5MHz bandwidth. This is because each cell in a GSM system must transmit a high power, continuous Broadcast Control Channel (BCCH) signal. A mobile station or terminal (e.g., a GSM cellular telephone) uses the BCCH transmission for synchronization and neighbor cell channel monitoring purposes. In addition, all of the network parameters as well as the paging messages are received from the BCCH carrier.

Those skilled in the art will appreciate that the interference from these continuously transmitted BCCH carriers must be somehow reduced, otherwise the introduction of a 200kHz network into a 1MHz bandwidth system is very difficult or technically impossible.

A 3-Carrier Compact Solution was adopted at a UWCC.GTF.PDFG/RF-group meeting 13-15.5.99 in Monterey

(UWCC.GTF.PDFG/99.04.13.38, 3-Carrier Compact Proposal). The 3-Carrier Compact Solution is a proposal for IS-136HS that maintains a spectrum deployment below 1MHz. The general idea is to use three carriers (600kHz) in a 1/3 reuse, but to achieve 9 or 12 reuse for control channels by using a 200kHz synchronous network. The 3-Carrier Compact Solution was presented to ETSI during a Paris EDGE SMG workshop (Tdoc SMG2 EDGE 122/99, Tdoc SMG2 EDGE 152/99, Tdoc SMG2 EDGE 153/99). Reference in this regard can be had to Appendix A of the above-referenced Provisional Patent Application No.: 60/136,494, filed 05/28/99.

In this proposal the control channel is discontinuously transmitted. As a result, the neighbor channel measurements and neighbor cell base station identity (BSIC) decoding become more difficult when the mobile station is in a traffic mode. However, the IS-136HS compact was developed for GPRS traffic only and, therefore, the mobile station neighbor channel measurement and BSIC decoding capabilities were viewed as sufficient for packet-only services.

However, the inventors have analyzed the neighbor channel measurement and neighbor channel BSIC decoding capability of the 3-Carrier Compact Solution. The results of this analysis are presented in Appendix B of the above-referenced Provisional Patent Application No.: 60/136,494, filed 05/28/99, which has been incorporated by reference herein in its entirety. In brief, the analysis shows that the 3-Carrier Compact Solution proposal has serious problems with delay critical services (including both circuit switched and packet switched services) when the mobile station must handle both uplink and downlink transactions during each GSM TDMA frame. In this case there will be only certain neighbor channel measurement and BSIC decoding positions where the mobile station is able to "see" the neighbor cell signal. Therefore, it has been

discovered that the mobile station will not be able to measure a sufficient number of neighbor cells, and will not be able to see a neighbor cell BSIC, without dropping some circuit switched traffic bursts. The necessity to drop traffic bursts in order to make neighbor cell channel measurements is obviously an undesirable solution for a number of reasons.

OBJECTS AND ADVANTAGES OF THE INVENTION:

It is a first object and advantage of this invention to facilitate the introduction of a 200kHz GSM-type network into a system having a bandwidth that is substantially less than the 2.5MHz bandwidth normally employed for GSM-type networks.

It is a second object and advantage of this invention to provide an improved and enhanced 3-Carrier Compact Solution.

SUMMARY OF THE INVENTION

The foregoing and other problems are overcome and the objects and advantages are realized by methods and apparatus in accordance with embodiments of this invention, wherein enhancements are made to the 3-Carrier Compact Solution.

More specifically, the mobile station's capability to see (i.e., receive) neighbor cell signals, when in the traffic mode, is improved by the teachings of this invention. This enhancement makes circuit switched services technically feasible to implement, as the mobile station is enabled to see of all the neighboring channel signals when in the traffic mode. That is, the mobile station can make a sufficient number of measurements from each neighbor

channel, and can also decode all neighbor channel BSICs, without dropping traffic bursts.

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A method in accordance with this invention thus enables the introduction of a 200kHz GSM-type network into a TDMA system having a bandwidth that is substantially less than a 2.5MHz bandwidth normally employed for GSM-type networks. The method has steps of providing a 52-multiframe that contains 12 blocks of four consecutive frames, two idle frames, and two channels used for the Packet Timing advance Control Channel (PTCCH); and rotating the control channels belonging to a serving time group over odd timeslot numbers as 7, 5, 3, 1, 7, 5, ..., etc. The rotation occurs between frame numbers $(FN) \bmod 52 = 3$ and 4. The packet switched logical channels Packet Data Traffic Channel (PDTCH), Packet Associated Control Channel (PACCH) and PTCCH are preferably not rotated.

The control channel rotation in accordance with this invention makes the mobile station cell reselection measurements possible during the traffic state, even in the case of a discontinuously transmitted control channel. This is because each neighbor cell control channel signal is caused to rotate periodically into the mobile station's neighbor cell measurement window. Traditionally, when the mobile station is involved with traffic it is constrained to receive and transmit bursts in fixed positions, and thus there is a limited neighbor cell measurement window after a transmission burst (TX) and before the next reception period (RX). In the conventional implementation the discontinuously transmitting control channel was at a fixed location, and thus the mobile station was not able to receive signals from all neighbor cells, when involved in traffic, without dropping some traffic.

BRIEF DESCRIPTION OF THE DRAWINGS

The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached
5 Drawings, wherein:

Fig. 1 is a block diagram of a mobile telecommunications system, having packet data capabilities, that is suitable for practicing this invention;

Fig. 2 illustrates the format of radio blocks in a 52 TDMA
10 multiframe; and

Fig. 3 shows the mapping of logical channels onto physical channels.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1, there is illustrated a simplified
15 block diagram of an embodiment of an exemplary wireless telecommunications system 1 that includes a plurality of mobile stations 10. Two mobile stations (MSs) are shown in the Figure, with one being designated MS#1 and the other MS#2. Fig. 1 also shows an exemplary network operator 2
20 having, for example, a mobile switching center (MSC) 3 for connecting to a telecommunications network, such as the Public Switched Telephone Network or PSTN, at least one base station controller (BSC) 4, and a plurality of base transceiver stations (BTS) 5 that transmit in a forward or
25 downlink direction both physical and logical channels to the mobile stations 10 in accordance with a predetermined air interface standard. It is assumed that a reverse or uplink communication path exists from the mobile station 10 to the network operator, which conveys mobile originated
30 access requests and traffic, including packet data traffic

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in accordance with an aspect of these teachings.

In the presently preferred, but not limiting, embodiment of these teachings, the air interface standard conforms to a
5 Time Division Multiple Access (TDMA) air interface and to the EGPRS protocol.

The network operator 2 can include Message Service Center (MSCT) that receives and forwards messages for the mobile stations 10, such as Short Message Service (SMS) messages,
10 or any wireless messaging technique including e-mail and Supplementary Data Services. Furthermore, enhancements to SMS can be used, such as one under development and known as Multimedia Messaging Service (MMS), wherein image messages,
15 video messages, audio messages, text messages, executables and the like, and combinations thereof, can be transferred between a network and a mobile station.

The mobile station 10 typically includes a microcontrol unit (MCU) 12 having an output coupled to an input of a display 14 and an input coupled to an output of a keyboard
20 or keypad 16. The mobile station 10 may be considered to be a handheld radiotelephone, such as a cellular telephone or a personal communicator, and may have a microphone and a speaker (not shown) for conducting voice communications. The mobile station 10 could also be contained within a card
25 or module that is connected during use to another device. For example, the mobile station 10 could be contained within a PCMCIA or similar type of card or module that is installed during use within a portable data processor, such as a laptop or notebook computer, or even a computer that
30 is wearable by the user.

The MCU 12 is assumed to include or be coupled to some type of a memory 13, including a read-only memory (ROM) for storing an operating program, as well as a random access

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memory (RAM) for temporarily storing required data, scratchpad memory, received data packets and data packets prepared for transmission, etc. A separate, removable SIM (not shown) can be provided as well, the SIM storing, for example, a preferred Public Land Mobile Network (PLMN) list and other subscriber-related information. The ROM is assumed, for the purposes of this invention, to store a program enabling the MCU 12 to execute the software routines required to operate in accordance with the presently preferred packet data protocols and procedures.

The mobile station 10 also contains a wireless section that includes a digital signal processor (DSP) 18, or equivalent high speed processor, as well as a wireless transceiver comprised of a transmitter 20 and a receiver 22, both of which are coupled to an antenna 24 for communication with the network operator 1.

A description is now given of a presently preferred enhancement to the 3-Carrier Compact Solution in accordance with an aspect of this invention, wherein time groups on each carrier are rotated. For example, a given one of the BTS 5 transmits/receives its control channel on frequency 1 at timeslot 7, and during the next 52-multiframe period the base station shifts its control channel transmission/reception to timeslot 5. This rotation continues multiframe by multiframe as, for this example, 7,5,3,1, 7,5,3,1, 7..., etc. The other three BTSs 5 which are transmitting their control channels on the same frequency 1 are also rotating their control channel positions by one timeslot relative to each other.

A method has a first step of providing a 52-multiframe that contains 12 blocks of four consecutive frames, two idle frames, and two channels used for the Packet Timing advance Control Channel (PTCCH), as is shown in Fig. 2. A block

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allocated to a given logical channel comprises one radio block or, in the uplink direction only, four random access bursts. The type of channel may vary on a block by block basis. Fig. 3 shows the frame numbers for each of the blocks (B0...B11) transmitted in the multiframe. The ordered list of blocks is defined as B0, B6, B3, B9, B1, B7, B4, B10, B2, B8, B5, B11. In the downlink direction, the logical channel type is indicated by the message type contained in the block header.

For the Compact solution of most interest to this invention, timeslot mapping and rotation of control channels is used such that, for a next step of the method, the control channels belonging to a serving time group are rotated over every other timeslot number. In a preferred embodiment of this invention the rotation occurs over odd timeslot numbers. In a most preferred embodiment of this invention the rotation occurs over odd timeslot numbers as 7, 5, 3, 1, 7, 5, ..., etc. The rotation occurs between frame numbers $(FN) \bmod 52 = 3$ and 4. The packet switched logical channels Packet Data Traffic Channel (PDTCH), Packet Associated Control Channel (PACCH) and PTCCH are preferably not rotated.

The mapping of the control channels on timeslot numbers is defined by the following formula:

For $0 \leq FN \bmod 52 \leq 3$, $TN = ((6 \times ((FN \bmod 52) \bmod 4)) + 1 + (2 \times TG)) \bmod 8$; and
 For $4 \leq FN \bmod 52 \leq 51$, $TN = ((6 \times ((FN \bmod 52) \bmod 4)) + 7 + (2 \times TG)) \bmod 8$.

The control channel rotation in accordance with this invention makes the mobile station cell reselection measurements possible during the traffic state, even in the case of a discontinuously transmitted control channel. This is because each neighbor cell control channel signal is

caused to rotate periodically into the mobile station's neighbor cell measurement window. Traditionally, when the mobile station is involved with traffic it is constrained to receive and transmit bursts in fixed positions, and thus there is a limited neighbor cell measurement window after a transmission burst (TX) and before the next reception period (RX). In the conventional implementation the discontinuously transmitting control channel was at a fixed location, and thus the mobile station was not able to receive signals from all neighbor cells, when involved in traffic, without dropping traffic.

One benefit from the control channel rotation is that the mobile station can see all the neighbors in its neighbor monitoring window, and is also able to decode all the neighbor BSICs regardless of the slots where the mobile station traffic is located. Therefore, the use of the rotating control channel enables the 3-Carrier Compact Solution to support circuit switched services on four timeslots which are not occupied for control channel usage. Another benefit of the base station control channel rotation is that the mobile station measurement implementation can be more readily performed, since the mobile station now sees all the neighbor base stations in its measurement window. A further benefit is that the network 1 is not required to organize idle periods for the mobile station 10 so that the mobile station would be enabled to perform cell reselection measurements during traffic times. Also, delay critical services (e.g., circuit switched voice over IP) are made possible, since the mobile station is not required to drop traffic to make neighbor cell reselection measurements. The mobile station 10 is also enabled to decode the BSIC from each neighbor cell during traffic, which is essential so that the mobile station is enabled to identify the neighbor cell before making a reselection to that cell.

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The Appendix A to this patent application shows examples of the utility of the teachings of this invention. Appendix A is identical to Annex D of a draft document ETSI EN 300 908 V8.3.0 (2000-01), Digital cellular telecommunications system (Phase 2+); Multiplexing and multiple access on the radio path (GSM 05.02 version 8.3.0 Release 1999). The content of this draft document is incorporated by reference herein in its entirety.

In the presently preferred embodiment the Packet Synchronization Channel (PSCH) is used to signal the rotation direction (and current rotation position) of the control channel to the mobile station 10.

More particularly, a Compact Synchronization Channel (CSCH) is arranged to contain two encoded parameters. The first parameter is the Base Transceiver Station 5 identity code (BSIC) which is six bits (before channel coding) having three bits of PLMN color code with a range of 0-7, and three bits of BS color code with range of 0-7, as defined in GSM 03.03. The second parameter is a Reduced TDMA frame number (RFN) which is 19 bits (before channel coding), arranged as follows:

R1 (10 bits) range 0-1023 = $FN \div (51 \times 52)$;
R2 (6 bits) range 0-50 = $(FN \div 52) \bmod 51$;
TG (2 bits) range 0-3; and
1 reserved bit; where
FN = TDMA Frame Number, as defined in GSM 05.02, subclause 4.3.3;
TG = Time Group as defined in GSM 05.02, subclause 4.3.4.

GSM 04.06 and GSM 04.08 specify the precise bit ordering, GSM 05.03 specifies the channel coding of the above parameters, and GSM 05.10 defines how the TDMA FN can be calculated from R1 and R2. The disclosures of the various GSM documents are incorporated by reference herein in their

entireties.

Those skilled in the art may derive other suitable information encoding and signalling techniques when guided by the foregoing teachings.

- 5 Thus, while the invention has been particularly shown and described with respect to preferred embodiments thereof, it will be understood by those skilled in the art that changes in form and details may be made therein without departing from the scope and spirit of the invention.

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COMPACT multiframe structure examples

In the figures, the 52-multiframe number (MFN) shall have a range of 0 to 3 and can be calculated from the TDMA frame number (FN) as follows:

$$\text{MFN} = (\text{FN} \div 52) \bmod 4$$

For COMPACT, timeslot mapping and rotation of the control channels is used such that control channels belonging to a serving time group are rotated over odd timeslot numbers as follows: 7, 5, 3, 1, 7, 5, The rotation occurs between frame numbers (FN) mod 52 = 3 and 4. The timeslot mapping and rotation of the control channels in this manner allows the mobile station to measure the received signal level from surrounding cells in its normal measurement window. Since the rotation repeats itself every 208 frames, the 52-multiframe number (MFN) allows the mobile station to determine its location in the time group rotation during selection and re-selection.

The following relates to Figures D.1 through D.7:

- i) $B(x)^y$ = time group y uses CPBCCCH in block x.
- ii) $C(x)^y$ = time group y uses CPCCCH in block x.
- iii) PTCCH = PTCCH as normal
- iv) $CFCCH^y$ = time group y uses CFCCH.
- v) $CSCH^y$ = time group y uses CSCH.
- vi) IDLE = idle burst.
- vii) X^y = block designated as idle for time group y.
- viii) Empty = used for traffic as normal.

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Frames 0-51 of a 208-multiframe MFN = 0 TG = 0							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	B(0) ⁰	X ¹	X ²	X ³			
1	B(0) ⁰	X ¹	X ²	X ³			
2	B(0) ⁰	X ¹	X ²	X ³			
3	B(0) ⁰	X ¹	X ²	X ³			
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	X ²	X ³	C(3) ⁰			
14	X ¹	X ²	X ³	C(3) ⁰			
15	X ¹	X ²	X ³	C(3) ⁰			
16	X ¹	X ²	X ³	C(3) ⁰			
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE			CFCCH ⁰			
26	X ¹	X ²	X ³	C(6) ⁰			
27	X ¹	X ²	X ³	C(6) ⁰			
28	X ¹	X ²	X ³	C(6) ⁰			
29	X ¹	X ²	X ³	C(6) ⁰			
30							
31							
32							
33							
34							
35							
36							
37	PTCCH						
38	X ¹	X ²	X ³	C(9) ⁰			
39	X ¹	X ²	X ³	C(9) ⁰			
40	X ¹	X ²	X ³	C(9) ⁰			
41	X ¹	X ²	X ³	C(9) ⁰			
42	X ¹	X ²	X ³	C(9) ⁰			
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE			CSCH ⁰			

Frames 0-51 of a 208-multiframe MFN = 0 TG = 1							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰		B(0) ¹	X ²	X ³		
1	X ⁰		B(0) ¹	X ²	X ³		
2	X ⁰		B(0) ¹	X ²	X ³		
3	X ⁰		B(0) ¹	X ²	X ³		
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	C(3) ¹	X ²	X ³	X ⁰			
14	C(3) ¹	X ²	X ³	X ⁰			
15	C(3) ¹	X ²	X ³	X ⁰			
16	C(3) ¹	X ²	X ³	X ⁰			
17							
18							
19							
20							
21							
22							
23							
24							
25	ID	CFCCH ¹		IDLE			
26	C(6) ¹	X ²	X ³	X ⁰			
27	C(6) ¹	X ²	X ³	X ⁰			
28	C(6) ¹	X ²	X ³	X ⁰			
29	C(6) ¹	X ²	X ³	X ⁰			
30							
31							
32							
33							
34							
35							
36							
37	PTCCH						
38	C(9) ¹	X ²	X ³	X ⁰			
39	C(9) ¹	X ²	X ³	X ⁰			
40	C(9) ¹	X ²	X ³	X ⁰			
41	C(9) ¹	X ²	X ³	X ⁰			
42	C(9) ¹	X ²	X ³	X ⁰			
43							
44							
45							
46							
47							
48							
49							
50							
51	ID	CSCH ¹		IDLE			

Frames 0-51 of a 208-multiframe MFN = 0 TG = 2							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰	X ¹	B(0) ²	X ³			
1	X ⁰	X ¹	B(0) ²	X ³			
2	X ⁰	X ¹	B(0) ²	X ³			
3	X ⁰	X ¹	B(0) ²	X ³			
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	C(3) ²	X ³	X ⁰			
14	X ¹	C(3) ²	X ³	X ⁰			
15	X ¹	C(3) ²	X ³	X ⁰			
16	X ¹	C(3) ²	X ³	X ⁰			
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE	CFCCH ²		IDLE			
26	X ¹	C(6) ²	X ³	X ⁰			
27	X ¹	C(6) ²	X ³	X ⁰			
28	X ¹	C(6) ²	X ³	X ⁰			
29	X ¹	C(6) ²	X ³	X ⁰			
30							
31							
32							
33							
34							
35							
36							
37	PTCCH						
38	X ¹	C(9) ²	X ³	X ⁰			
39	X ¹	C(9) ²	X ³	X ⁰			
40	X ¹	C(9) ²	X ³	X ⁰			
41	X ¹	C(9) ²	X ³	X ⁰			
42	X ¹	C(9) ²	X ³	X ⁰			
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE	CSCH ²		IDLE			

Frames 0-51 of a 208-multiframe MFN = 0 TG = 3							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰	X ¹	X ²	B(0) ³			
1	X ⁰	X ¹	X ²	B(0) ³			
2	X ⁰	X ¹	X ²	B(0) ³			
3	X ⁰	X ¹	X ²	B(0) ³			
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	X ²	C(3) ³	X ⁰			
14	X ¹	X ²	C(3) ³	X ⁰			
15	X ¹	X ²	C(3) ³	X ⁰			
16	X ¹	X ²	C(3) ³	X ⁰			
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE			CFCCH ³			
26	X ¹	X ²	C(6) ³	X ⁰			
27	X ¹	X ²	C(6) ³	X ⁰			
28	X ¹	X ²	C(6) ³	X ⁰			
29	X ¹	X ²	C(6) ³	X ⁰			
30							
31							
32							
33							
34							
35							
36							
37	PTCCH						
38	X ¹	X ²	C(9) ³	X ⁰			
39	X ¹	X ²	C(9) ³	X ⁰			
40	X ¹	X ²	C(9) ³	X ⁰			
41	X ¹	X ²	C(9) ³	X ⁰			
42	X ¹	X ²	C(9) ³	X ⁰			
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE			CSCH ³			

Figure D.1: COMPACT downlink 52-multiframe structure using 4 time groups for nominal cells (based on an assignment of 1 CPBCH and 3 CPCCCHs with NIB_CPBCH_0 = NIB_CCCH_1 = NIB_CCCH_2 = NIB_CCCH_3 = 4). NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in clause 7 Table 6.

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 0							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	B(0) ⁰	X ¹	X ²				
1	B(0) ⁰	X ¹	X ²				
2	B(0) ⁰	X ¹	X ²				
3	B(0) ⁰	X ¹	X ²				
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	X ²			C(3) ⁰		
14	X ¹	X ²			C(3) ⁰		
15	X ¹	X ²			C(3) ⁰		
16	X ¹	X ²			C(3) ⁰		
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE				CFCCH ¹		
26	X ¹	X ²			C(6) ⁰		
27	X ¹	X ²			C(6) ⁰		
28	X ¹	X ²			C(6) ⁰		
29	X ¹	X ²			C(6) ⁰		
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	X ¹	X ²			C(9) ⁰		
40	X ¹	X ²			C(9) ⁰		
41	X ¹	X ²			C(9) ⁰		
42	X ¹	X ²			C(9) ⁰		
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE				CSCH ⁰		

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 1							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰		B(0) ¹	X ²			
1	X ⁰		B(0) ¹	X ²			
2	X ⁰		B(0) ¹	X ²			
3	X ⁰		B(0) ¹	X ²			
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	C(3) ¹	X ²			X ⁰		
14	C(3) ¹	X ²			X ⁰		
15	C(3) ¹	X ²			X ⁰		
16	C(3) ¹	X ²			X ⁰		
17							
18							
19							
20							
21							
22							
23							
24							
25	ID	CFCCH ¹		IDLE			
26	C(6) ¹	X ²			X ⁰		
27	C(6) ¹	X ²			X ⁰		
28	C(6) ¹	X ²			X ⁰		
29	C(6) ¹	X ²			X ⁰		
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	C(9) ¹	X ²			X ⁰		
40	C(9) ¹	X ²			X ⁰		
41	C(9) ¹	X ²			X ⁰		
42	C(9) ¹	X ²			X ⁰		
43							
44							
45							
46							
47							
48							
49							
50							
51	ID	CSCH ¹		IDLE			

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 2							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰		X ¹		B(0) ²		
1	X ⁰		X ¹		B(0) ²		
2	X ⁰		X ¹		B(0) ²		
3	X ⁰		X ¹		B(0) ²		
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹		C(3) ²			X ⁰	
14	X ¹		C(3) ²			X ⁰	
15	X ¹		C(3) ²			X ⁰	
16	X ¹		C(3) ²			X ⁰	
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE		CFCCH ²		IDLE		
26	X ¹		C(6) ²			X ⁰	
27	X ¹		C(6) ²			X ⁰	
28	X ¹		C(6) ²			X ⁰	
29	X ¹		C(6) ²			X ⁰	
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	X ¹		C(9) ²			X ⁰	
40	X ¹		C(9) ²			X ⁰	
41	X ¹		C(9) ²			X ⁰	
42	X ¹		C(9) ²			X ⁰	
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE		CSCH ²		IDLE		

Figure D.2: COMPACT downlink 52-multiframe structure using 3 time groups for nominal cells (based on an assignment of 1 CPBCH and 3 CPCCCHs with NIB_CCCH_0 = NIB_CCCH_1 = NIB_CCCH_2 = 4, NIB_CCCH_3 = 0). NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in Clause 7 Table 6.

Frames 0-51 of a 208-multiframe
MFN = 0
TG = 0

TS	0	1	2	3	4	5	6	7
FN	0	1	2	3	4	5	6	7
0	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²	X ²
1	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²	X ²
2	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²	X ²
3	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²	X ²
4								
5								
6								
7								
8								
9								
10								
11								
12								
13	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(3) ⁰
14	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(3) ⁰
15	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(3) ⁰
16	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(3) ⁰
17								
18								
19								
20								
21								
22								
23								
24								
25								
26	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(6) ⁰
27	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(6) ⁰
28	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(6) ⁰
29	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(6) ⁰
30								
31								
32								
33								
34								
35								
36								
37								
38								
39	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(9) ⁰
40	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(9) ⁰
41	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(9) ⁰
42	X ¹	X ¹	X ²	X ²	X ³	X ³	X ³	C(9) ⁰
43								
44								
45								
46								
47								
48								
49								
50								
51								

Frames 0-51 of a 208-multiframe
MFN = 0
TG = 1

TS	0	1	2	3	4	5	6	7
FN	0	1	2	3	4	5	6	7
0	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²	X ²
1	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²	X ²
2	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²	X ²
3	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²	X ²
4								
5								
6								
7								
8								
9								
10								
11								
12								
13	X ¹	C(3) ¹	X ²	X ²	X ³	X ³	X ³	X ³
14	X ¹	C(3) ¹	X ²	X ²	X ³	X ³	X ³	X ³
15	X ¹	C(3) ¹	X ²	X ²	X ³	X ³	X ³	X ³
16	X ¹	C(3) ¹	X ²	X ²	X ³	X ³	X ³	X ³
17								
18								
19								
20								
21								
22								
23								
24								
25	ID	CFCCH ¹			IDLE			
26	X ¹	C(6) ¹	X ²	X ²	X ³	X ³	X ³	X ³
27	X ¹	C(6) ¹	X ²	X ²	X ³	X ³	X ³	X ³
28	X ¹	C(6) ¹	X ²	X ²	X ³	X ³	X ³	X ³
29	X ¹	C(6) ¹	X ²	X ²	X ³	X ³	X ³	X ³
30								
31								
32								
33								
34								
35								
36								
37								
38								
39	X ¹	C(9) ¹	X ²	X ²	X ³	X ³	X ³	X ³
40	X ¹	C(9) ¹	X ²	X ²	X ³	X ³	X ³	X ³
41	X ¹	C(9) ¹	X ²	X ²	X ³	X ³	X ³	X ³
42	X ¹	C(9) ¹	X ²	X ²	X ³	X ³	X ³	X ³
43								
44								
45								
46								
47								
48								
49								
50								
51	ID	CSCH ¹			IDLE			

Frames 0-51 of a 208-multiframe
MFN = 0
TG = 2

TS	0	1	2	3	4	5	6	7
FN	0	1	2	3	4	5	6	7
0	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ³	X ³
1	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ³	X ³
2	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ³	X ³
3	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ³	X ³
4								
5								
6								
7								
8								
9								
10								
11								
12								
13	X ¹	X ¹	X ²	C(3) ²	X ³	X ³	X ³	X ³
14	X ¹	X ¹	X ²	C(3) ²	X ³	X ³	X ³	X ³
15	X ¹	X ¹	X ²	C(3) ²	X ³	X ³	X ³	X ³
16	X ¹	X ¹	X ²	C(3) ²	X ³	X ³	X ³	X ³
17								
18								
19								
20								
21								
22								
23								
24								
25	IDLE							
26	X ¹	X ¹	X ²	C(6) ²	X ³	X ³	X ³	X ³
27	X ¹	X ¹	X ²	C(6) ²	X ³	X ³	X ³	X ³
28	X ¹	X ¹	X ²	C(6) ²	X ³	X ³	X ³	X ³
29	X ¹	X ¹	X ²	C(6) ²	X ³	X ³	X ³	X ³
30								
31								
32								
33								
34								
35								
36								
37								
38								
39	X ¹	X ¹	X ²	C(9) ²	X ³	X ³	X ³	X ³
40	X ¹	X ¹	X ²	C(9) ²	X ³	X ³	X ³	X ³
41	X ¹	X ¹	X ²	C(9) ²	X ³	X ³	X ³	X ³
42	X ¹	X ¹	X ²	C(9) ²	X ³	X ³	X ³	X ³
43								
44								
45								
46								
47								
48								
49								
50								
51	IDLE							

Frames 0-51 of a 208-multiframe
MFN = 0
TG = 3

TS	0	1	2	3	4	5	6	7
FN	0	1	2	3	4	5	6	7
0	X ⁰	X ⁰	X ¹	X ¹	X ²	X ²	X ²	B(0) ³
1	X ⁰	X ⁰	X ¹	X ¹	X ²	X ²	X ²	B(0) ³
2	X ⁰	X ⁰	X ¹	X ¹	X ²	X ²	X ²	B(0) ³
3	X ⁰	X ⁰	X ¹	X ¹	X ²	X ²	X ²	B(0) ³
4								
5								

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 0							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²
1	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²
2	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²
3	X ⁰	B(0) ⁰	X ¹	X ¹	X ²	X ²	X ²
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	X ¹	X ²	X ²	X ²	X ³	C(3) ⁰
14	X ¹	X ¹	X ²	X ²	X ²	X ³	C(3) ⁰
15	X ¹	X ¹	X ²	X ²	X ²	X ³	C(3) ⁰
16	X ¹	X ¹	X ²	X ²	X ²	X ³	C(3) ⁰
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE						CFCCH ⁰
26	X ¹	X ¹	X ²	X ²	X ²	X ³	C(6) ⁰
27	X ¹	X ¹	X ²	X ²	X ²	X ³	C(6) ⁰
28	X ¹	X ¹	X ²	X ²	X ²	X ³	C(6) ⁰
29	X ¹	X ¹	X ²	X ²	X ²	X ³	C(6) ⁰
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	X ¹	X ¹	X ²	X ²	X ²	X ³	C(9) ⁰
40	X ¹	X ¹	X ²	X ²	X ²	X ³	C(9) ⁰
41	X ¹	X ¹	X ²	X ²	X ²	X ³	C(9) ⁰
42	X ¹	X ¹	X ²	X ²	X ²	X ³	C(9) ⁰
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE						CSCH ⁰

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 1							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²
1	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²
2	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²
3	X ⁰	X ⁰	X ¹	B(0) ¹	X ²	X ²	X ²
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	C(3) ¹	X ²	X ²	X ²	X ³	X ³
14	X ¹	C(3) ¹	X ²	X ²	X ²	X ³	X ³
15	X ¹	C(3) ¹	X ²	X ²	X ²	X ³	X ³
16	X ¹	C(3) ¹	X ²	X ²	X ²	X ³	X ³
17							
18							
19							
20							
21							
22							
23							
24							
25	ID	CFCCH ¹	IDLE				
26	X ¹	C(6) ¹	X ²	X ²	X ²	X ³	X ³
27	X ¹	C(6) ¹	X ²	X ²	X ²	X ³	X ³
28	X ¹	C(6) ¹	X ²	X ²	X ²	X ³	X ³
29	X ¹	C(6) ¹	X ²	X ²	X ²	X ³	X ³
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	X ¹	C(9) ¹	X ²	X ²	X ²	X ³	X ³
40	X ¹	C(9) ¹	X ²	X ²	X ²	X ³	X ³
41	X ¹	C(9) ¹	X ²	X ²	X ²	X ³	X ³
42	X ¹	C(9) ¹	X ²	X ²	X ²	X ³	X ³
43							
44							
45							
46							
47							
48							
49							
50							
51	ID	CSCH ¹	IDLE				

Frames 0-51 of a 208-multiframe							
MFN = 0							
TG = 2							
TS	0	1	2	3	4	5	6
FN	0	1	2	3	4	5	6
0	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ²
1	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ²
2	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ²
3	X ⁰	X ⁰	X ¹	X ¹	X ²	B(0) ²	X ²
4							
5							
6							
7							
8							
9							
10							
11							
12	PTCCH						
13	X ¹	X ¹	X ²	C(3) ²	X ²	X ³	X ³
14	X ¹	X ¹	X ²	C(3) ²	X ²	X ³	X ³
15	X ¹	X ¹	X ²	C(3) ²	X ²	X ³	X ³
16	X ¹	X ¹	X ²	C(3) ²	X ²	X ³	X ³
17							
18							
19							
20							
21							
22							
23							
24							
25	IDLE		CFCCH ²		IDLE		
26	X ¹	X ¹	X ²	C(6) ²	X ²	X ³	X ³
27	X ¹	X ¹	X ²	C(6) ²	X ²	X ³	X ³
28	X ¹	X ¹	X ²	C(6) ²	X ²	X ³	X ³
29	X ¹	X ¹	X ²	C(6) ²	X ²	X ³	X ³
30							
31							
32							
33							
34							
35							
36							
37							
38	PTCCH						
39	X ¹	X ¹	X ²	C(9) ²	X ²	X ³	X ³
40	X ¹	X ¹	X ²	C(9) ²	X ²	X ³	X ³
41	X ¹	X ¹	X ²	C(9) ²	X ²	X ³	X ³
42	X ¹	X ¹	X ²	C(9) ²	X ²	X ³	X ³
43							
44							
45							
46							
47							
48							
49							
50							
51	IDLE		CSCH ²		IDLE		

Figure D.4: COMPACT downlink 52-multiframe structure using 3 time groups for large cells (based on an assignment of 1 CPBCCCH and 3 CPCCCHs with NIB_CCCH_0 = NIB_CCCH_1 = NIB_CCCH_2 = 4, NIB_CPBCCCH_3 = 0). NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in Clause 7 Table 6.

Frames 0-51 of a 208-multiframe MFN = 0									Frames 52-103 of a 208-multiframe MFN = 1									Frames 104-155 of a 208-multiframe MFN = 2									Frames 156-207 of a 208-multiframe MFN = 3								
TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7
FN									FN									FN									FN								
0	B(0) ^u	X ¹	X ²	X ³					52	X ¹	X ²	X ³	X ⁴	B(0) ^u				104	X ²	X ³	B(0) ^u	X ¹				156	X ²	B(0) ^u	X ¹	X ²					
1	B(0) ^u	X ¹	X ²	X ³					53	X ¹	X ²	X ³	X ⁴	B(0) ^u				105	X ²	X ³	B(0) ^u	X ¹				157	X ²	B(0) ^u	X ¹	X ²	X ³				
2	B(0) ^u	X ¹	X ²	X ³					54	X ¹	X ²	X ³	X ⁴	B(0) ^u				106	X ²	X ³	B(0) ^u	X ¹				158	X ²	B(0) ^u	X ¹	X ²	X ³				
3	B(0) ^u	X ¹	X ²	X ³					55	X ¹	X ²	X ³	X ⁴	B(0) ^u				107	X ²	X ³	B(0) ^u	X ¹				159	X ²	B(0) ^u	X ¹	X ²	X ³				
4									56									108								160									
5									57									109								161									
6									58									110								162									
7									59									111								163									
8									60									112								164									
9									61									113								165									
10									62									114								166									
11									63									115								167									
12	PTCCH								64	PTCCH								116	PTCCH								168	PTCCH							
13	X ¹	X ²	X ³	X ⁴	C(3) ^u				65	X ²	X ³	C(3) ^u	X ¹				117	X ²	C(3) ^u	X ¹	X ²				169	C(3) ^u	X ¹	X ²	X ³	X ⁴					
14	X ¹	X ²	X ³	X ⁴	C(3) ^u				66	X ²	X ³	C(3) ^u	X ¹				118	X ²	C(3) ^u	X ¹	X ²				170	C(3) ^u	X ¹	X ²	X ³	X ⁴					
15	X ¹	X ²	X ³	X ⁴	C(3) ^u				67	X ²	X ³	C(3) ^u	X ¹				119	X ²	C(3) ^u	X ¹	X ²				171	C(3) ^u	X ¹	X ²	X ³	X ⁴					
16	X ¹	X ²	X ³	X ⁴	C(3) ^u				68	X ²	X ³	C(3) ^u	X ¹				120	X ²	C(3) ^u	X ¹	X ²				172	C(3) ^u	X ¹	X ²	X ³	X ⁴					
17									69								121								173										
18									70								122								174										
19									71								123								175										
20									72								124								176										
21									73								125								177										
22									74								126								178										
23									75								127								179										
24									76								128								180										
25	IDLE				CFCCH ¹				77	IDLE				CFCCH ¹	IDLE		129	IDLE	CFCCH ¹	IDLE					181	ID	CFCCH ¹	IDLE							
26	X ¹	X ²	X ³	C(6) ^u					78	X ²	X ³	C(6) ^u	X ¹			130	X ²	C(6) ^u	X ¹	X ²				182	C(6) ^u	X ¹	X ²	X ³	X ⁴						
27	X ¹	X ²	X ³	C(6) ^u					79	X ²	X ³	C(6) ^u	X ¹			131	X ²	C(6) ^u	X ¹	X ²				183	C(6) ^u	X ¹	X ²	X ³	X ⁴						
28	X ¹	X ²	X ³	C(6) ^u					80	X ²	X ³	C(6) ^u	X ¹			132	X ²	C(6) ^u	X ¹	X ²				184	C(6) ^u	X ¹	X ²	X ³	X ⁴						
29	X ¹	X ²	X ³	C(6) ^u					81	X ²	X ³	C(6) ^u	X ¹			133	X ²	C(6) ^u	X ¹	X ²				185	C(6) ^u	X ¹	X ²	X ³	X ⁴						
30									82							134								186											
31									83							135								187											
32									84							136								188											
33									85							137								189											
34									86							138								190											
35									87							139								191											
36									88							140								192											
37									89							141								193											
38	PTCCH								90	PTCCH								142	PTCCH								194	PTCCH							
39	X ¹	X ²	X ³	C(9) ^u					91	X ²	X ³	C(9) ^u	X ¹			143	X ²	C(9) ^u	X ¹	X ²				195	C(9) ^u	X ¹	X ²	X ³	X ⁴						
40	X ¹	X ²	X ³	C(9) ^u					92	X ²	X ³	C(9) ^u	X ¹			144	X ²	C(9) ^u	X ¹	X ²				196	C(9) ^u	X ¹	X ²	X ³	X ⁴						
41	X ¹	X ²	X ³	C(9) ^u					93	X ²	X ³	C(9) ^u	X ¹			145	X ²	C(9) ^u	X ¹	X ²				197	C(9) ^u	X ¹	X ²	X ³	X ⁴						
42	X ¹	X ²	X ³	C(9) ^u					94	X ²	X ³	C(9) ^u	X ¹			146	X ²	C(9) ^u	X ¹	X ²				198	C(9) ^u	X ¹	X ²	X ³	X ⁴						
43									95							147								199											
44									96							148								200											
45									97							149								201											
46									98							150								202											
47									99							151								203											
48									100							152								204											
49									101							153								205											
50									102							154								206											
51	IDLE				CSCH ¹				103	IDLE				CSCH ¹	IDLE		155	IDLE	CSCH ¹	IDLE				207	ID	CSCH ¹	IDLE								

Figure D.5: Example of COMPACT downlink timeslot mapping and rotation of control channels using 4 time groups for nominal cells (based on an assignment of 1 CPBCCCH and 3 CPCCCHs with NIB_CCCH_0 = NIB_CCCH_1 = NIB_CCCH_2 = NIB_CCCH_3 = 4). TG = 0 is illustrated. NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in Clause 7 Table 6.

Frames 0-51 of a 208-multiframe MFN = 0								Frames 52-103 of a 208-multiframe MFN = 1								Frames 104-155 of a 208-multiframe MFN = 2								Frames 156-207 of a 208-multiframe MFN = 3																		
TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7							
FN									FN									FN									FN															
0	B(0) ^u			X ¹		X ²			52		X ¹		X ²				B(0) ^u	104		X ²					B(0) ^u		X ¹							156				B(0) ^u		X ¹		X ²
1	B(0) ^u			X ¹		X ²			53		X ¹		X ²				B(0) ^u	105		X ²					B(0) ^u		X ¹							157				B(0) ^u		X ¹		X ²
2	B(0) ^u			X ¹		X ²			54		X ¹		X ²				B(0) ^u	106		X ²					B(0) ^u		X ¹							158				B(0) ^u		X ¹		X ²
3	B(0) ^u			X ¹		X ²			55		X ¹		X ²				B(0) ^u	107		X ²					B(0) ^u		X ¹							159				B(0) ^u		X ¹		X ²
4									56									108																	160							
5									57									109																	161							
6									58									110																	162							
7									59									111																	163							
8									60									112																	164							
9									61									113																	165							
10									62									114																	166							
11									63									115																	167							
12	PTCCH								64	PTCCH								116	PTCCH								168	PTCCH														
13		X ¹		X ²				C(3) ^u	65		X ²				C(3) ^u		X ¹	117				C(3) ^u		X ¹		X ²	169		C(3) ^u		X ¹		X ²			173						
14		X ¹		X ²				C(3) ^u	66		X ²				C(3) ^u		X ¹	118				C(3) ^u		X ¹		X ²	170		C(3) ^u		X ¹		X ²			174						
15		X ¹		X ²				C(3) ^u	67		X ²				C(3) ^u		X ¹	119				C(3) ^u		X ¹		X ²	171		C(3) ^u		X ¹		X ²			175						
16		X ¹		X ²				C(3) ^u	68		X ²				C(3) ^u		X ¹	120				C(3) ^u		X ¹		X ²	172		C(3) ^u		X ¹		X ²			176						
17									69									121									173									177						
18									70									122									174									178						
19									71									123									175									179						
20									72									124									176									180						
21									73									125									177									181	ID	CFCCH ¹		IDLE		
22									74									126									178									182		C(6) ^u		X ¹		X ²
23									75									127									179									183		C(6) ^u		X ¹		X ²
24									76									128									180									184		C(6) ^u		X ¹		X ²
25	IDLE							CFCCH ¹	77	IDLE							CFCCH ¹	IDLE	129	IDLE	CFCCH ¹		IDLE	181	ID	CFCCH ¹		IDLE	185		C(6) ^u		X ¹		X ²							
26		X ¹		X ²				C(6) ^u	78		X ²				C(6) ^u		X ¹	130				C(6) ^u		X ¹		X ²	186									187						
27		X ¹		X ²				C(6) ^u	79		X ²				C(6) ^u		X ¹	131				C(6) ^u		X ¹		X ²	187									188						
28		X ¹		X ²				C(6) ^u	80		X ²				C(6) ^u		X ¹	132				C(6) ^u		X ¹		X ²	188									189						
29		X ¹		X ²				C(6) ^u	81		X ²				C(6) ^u		X ¹	133				C(6) ^u		X ¹		X ²	189									190						
30									82									134									190									191						
31									83									135									191									192						
32									84									136									192									193						
33									85									137									193									194						
34									86									138									194									195		C(9) ^u		X ¹		X ²
35									87									139									195		C(9) ^u		X ¹		X ²			196		C(9) ^u		X ¹		X ²
36									88									140									196		C(9) ^u		X ¹		X ²			197		C(9) ^u		X ¹		X ²
37									89									141									197		C(9) ^u		X ¹		X ²			198		C(9) ^u		X ¹		X ²
38	PTCCH								90	PTCCH								142	PTCCH								198	PTCCH														
39		X ¹		X ²				C(9) ^u	91		X ²				C(9) ^u		X ¹	143				C(9) ^u		X ¹		X ²	199									200						
40		X ¹		X ²				C(9) ^u	92		X ²				C(9) ^u		X ¹	144				C(9) ^u		X ¹		X ²	200									201						
41		X ¹		X ²				C(9) ^u	93		X ²				C(9) ^u		X ¹	145				C(9) ^u		X ¹		X ²	201									202						
42		X ¹		X ²				C(9) ^u	94		X ²				C(9) ^u		X ¹	146				C(9) ^u		X ¹		X ²	202									203						
43									95									147									203									204						
44									96									148									204									205						
45									97									149									205									206						
46									98									150									206									207	ID	CSCH ¹		IDLE		
47									99									151									207															
48									100									152									208															
49									101									153									209															
50									102									154									210															
51	IDLE							CSCH ¹	103	IDLE							CSCH ¹	IDLE	155	IDLE	CSCH ¹		IDLE	211	ID	CSCH ¹		IDLE	215													

Figure D.6: Example of COMPACT downlink timeslot mapping and rotation of control channels using 3 time groups for nominal cells (based on an assignment of 1 CPBCH and 3 CPCCCHs with NIB_CCCH_0 = NIB_CCCH_1 = NIB_CCCH_2 = 4, NIB_CCCH_3 = 0). TG = 0 is illustrated. NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in Clause 7 Table 6.

Frames 0-51 of a 208-multiframe MFN = 0								Frames 52-103 of a 208-multiframe MFN = 1								Frames 104-155 of a 208-multiframe MFN = 2								Frames 156-207 of a 208-multiframe MFN = 3											
TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7	TS	0	1	2	3	4	5	6	7
FN	0	1	2	3	4	5	6	7	FN	0	1	2	3	4	5	6	7	FN	0	1	2	3	4	5	6	7	FN	0	1	2	3	4	5	6	7
0	B(0) ^u	X ¹	X ²	X ³					52	X ¹	X ²	X ³					B(0) ^u	104	X ²	X ³			B(0) ^u	X ¹		156	X ³		B(0) ^u	X ¹	X ²				
1	B(0) ^u	X ¹	X ²	X ³					53	X ¹	X ²	X ³					B(0) ^u	105	X ²	X ³			B(0) ^u	X ¹		157	X ³		B(0) ^u	X ¹	X ²				
2	B(0) ^u	X ¹	X ²	X ³					54	X ¹	X ²	X ³					B(0) ^u	106	X ²	X ³			B(0) ^u	X ¹		158	X ³		B(0) ^u	X ¹	X ²				
3	B(0) ^u	X ¹	X ²	X ³					55	X ¹	X ²	X ³					B(0) ^u	107	X ²	X ³			B(0) ^u	X ¹		159	X ³		B(0) ^u	X ¹	X ²				
4	X ¹								56								X ¹	108								160			X ¹						
5	X ¹								57								X ¹	109								161			X ¹						
6	X ¹								58								X ¹	110								162			X ¹						
7	X ¹								59								X ¹	111								163			X ¹						
8									60									112								164									
9									61									113								165									
10									62									114								166									
11									63									115								167									
12									64									116								168									
13	X ¹	X ²	X ³					C(3) ^u	65	X ²	X ³						C(3) ^u	117	X ³	C(3) ^u	X ¹	X ²			169	C(3) ^u	X ¹	X ²	X ³						
14	X ¹	X ²	X ³					C(3) ^u	66	X ²	X ³						C(3) ^u	118	X ³	C(3) ^u	X ¹	X ²			170	C(3) ^u	X ¹	X ²	X ³						
15	X ¹	X ²	X ³					C(3) ^u	67	X ²	X ³						C(3) ^u	119	X ³	C(3) ^u	X ¹	X ²			171	C(3) ^u	X ¹	X ²	X ³						
16	X ¹	X ²	X ³					C(3) ^u	68	X ²	X ³						C(3) ^u	120	X ³	C(3) ^u	X ¹	X ²			172	C(3) ^u	X ¹	X ²	X ³						
17									69									121								173									
18									70									122								174									
19									71									123								175									
20									72									124								176									
21									73									125								177									
22									74									126								178									
23									75									127								179									
24									76									128								180									
25									77									129	IDLE	CFCCH ¹	IDLE					181	ID	CFCCH ¹	IDLE						
26	X ¹	X ²	X ³					C(6) ^u	78	X ²	X ³						C(6) ^u	130	X ³	C(6) ^u	X ¹	X ²			182	C(6) ^u	X ¹	X ²	X ³						
27	X ¹	X ²	X ³					C(6) ^u	79	X ²	X ³						C(6) ^u	131	X ³	C(6) ^u	X ¹	X ²			183	C(6) ^u	X ¹	X ²	X ³						
28	X ¹	X ²	X ³					C(6) ^u	80	X ²	X ³						C(6) ^u	132	X ³	C(6) ^u	X ¹	X ²			184	C(6) ^u	X ¹	X ²	X ³						
29	X ¹	X ²	X ³					C(6) ^u	81	X ²	X ³						C(6) ^u	133	X ³	C(6) ^u	X ¹	X ²			185	C(6) ^u	X ¹	X ²	X ³						
30									82									134								186									
31									83									135								187									
32									84									136								188									
33									85									137								189									
34									86									138								190									
35									87									139								191									
36									88									140								192									
37									89									141								193									
38									90									142								194									
39	X ¹	X ²	X ³					C(9) ^u	91	X ²	X ³						C(9) ^u	143	X ³	C(9) ^u	X ¹	X ²			195	C(9) ^u	X ¹	X ²	X ³						
40	X ¹	X ²	X ³					C(9) ^u	92	X ²	X ³						C(9) ^u	144	X ³	C(9) ^u	X ¹	X ²			196	C(9) ^u	X ¹	X ²	X ³						
41	X ¹	X ²	X ³					C(9) ^u	93	X ²	X ³						C(9) ^u	145	X ³	C(9) ^u	X ¹	X ²			197	C(9) ^u	X ¹	X ²	X ³						
42	X ¹	X ²	X ³					C(9) ^u	94	X ²	X ³						C(9) ^u	146	X ³	C(9) ^u	X ¹	X ²			198	C(9) ^u	X ¹	X ²	X ³						
43									95									147								199									
44									96									148								200									
45									97									149								201									
46									98									150								202									
47									99									151								203									
48									100									152								204									
49									101									153								205									
50									102									154								206									
51									103									155	IDLE	CSCH ¹	IDLE					207	ID	CSCH ¹	IDLE						

Figure D.7: Example of COMPACT downlink timeslot mapping and rotation of control channels using 4 time groups for nominal cells (based on an assignment of 1 CPBCH and 3 CPCCCHs with NIB_CCCH_0 = NIB_CCCH_2 = NIB_CCCH_3 = 4, NIB_CCCH_1 = 5). TG = 0 is illustrated. NIB_CCCH is not broadcast for serving cell time group.

NOTE: For uplink 52-multiframe structure (based on an assignment of 16 prioritized CPRACHs, see subclause 6.3.2.2.3a), replace B() by R() where R() denotes CPRACH, move down one block, and rotate according to subclause 6.3.2.1. Replace C() by R() and move down one block. CPRACH in general can be mapped as PRACH in Clause 7 Table 6.

CLAIMS

What is claimed is:

1. A method for enabling the introduction of a 200kHz GSM-type network into a TDMA system having a bandwidth that is substantially less than a 2.5MHz bandwidth normally employed for GSM-type networks, comprising the steps of:

providing a 52-multiframe containing 12 blocks of four consecutive frames, two idle frames, and two channels used for control channel purposes; and

rotating control channels belonging to a serving time group over every other timeslot number.

2. A method as in claim 1, wherein the rotation occurs over odd timeslot numbers as 7, 5, 3, 1, 7, 5, ..., etc., and where the rotation occurs between frame numbers (FN) $\text{mod } 52 = 3$ and 4.

3. A method as in claim 1, wherein a mapping of the control channels on timeslot numbers is defined by the following formula:

For $0 \leq \text{FN mod } 52 \leq 3$, $\text{TN} = ((6 \times ((\text{FN div } 52) \text{ mod } 4)) + 1 + (2 \times \text{TG})) \text{ mod } 8$; and

For $4 \leq \text{FN mod } 52 \leq 51$, $\text{TN} = ((6 \times ((\text{FN div } 52) \text{ mod } 4)) + 7 + (2 \times \text{TG})) \text{ mod } 8$,

where TG is a time group value.

4. A method as in claim 1, wherein information specifying at least the rotation direction is signalled to the mobile station in a downlink synchronization channel.

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5. A wireless TDMA digital communications system, comprising:

at least one mobile station; and

a plurality of base transceiver stations individual ones of which are capable of transmitting packet data to, and receiving packet data from, said mobile station using a 52-multiframe, wherein individual ones of said base transceiver stations rotate the transmission of control channels belonging to a serving time group over every other timeslot number for enabling said mobile station to perform reselection measurements on neighboring base transceiver stations without dropping traffic.

6. A system as in claim 5, wherein the rotation occurs between frame numbers $(FN) \bmod 52 = 3$ and 4.

7. A system as in claim 5, wherein a mapping of the control channels on timeslot numbers is defined by the following formula:

For $0 \leq FN \bmod 52 \leq 3$, $TN = ((6 \times ((FN \div 52) \bmod 4)) + 1 + (2 \times TG)) \bmod 8$; and

For $4 \leq FN \bmod 52 \leq 51$, $TN = ((6 \times ((FN \div 52) \bmod 4)) + 7 + (2 \times TG)) \bmod 8$,

where TG is a time group value.

8. A system as in claim 5, wherein information specifying at least the rotation direction is signalled to the mobile station in a downlink synchronization channel.

9. A system as in claim 5, wherein the rotation of the control channels occurs in odd timeslot numbers as 7, 5, 3, 1, 7, 5, ..., etc.

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ENHANCEMENTS TO THE 3-CARRIER COMPACT
SOLUTION FOR IS136HS

ABSTRACT OF THE DISCLOSURE

A method enables the introduction of a 200kHz GSM-type network into a TDMA system having a bandwidth that is substantially less than a 2.5MHz bandwidth normally employed for GSM-type networks. The method provides a 52-multiframe containing 12 blocks of four consecutive frames, two idle frames, and two control channels, and rotates the control channels belonging to a serving time group over odd timeslot numbers as 7, 5, 3, 1, 7, 5, ..., etc. Preferably the rotation occurs between frame numbers $(FN) \bmod 52 = 3$ and 4. Information specifying at least the rotation direction is signalled to the mobile station in a downlink synchronization channel.

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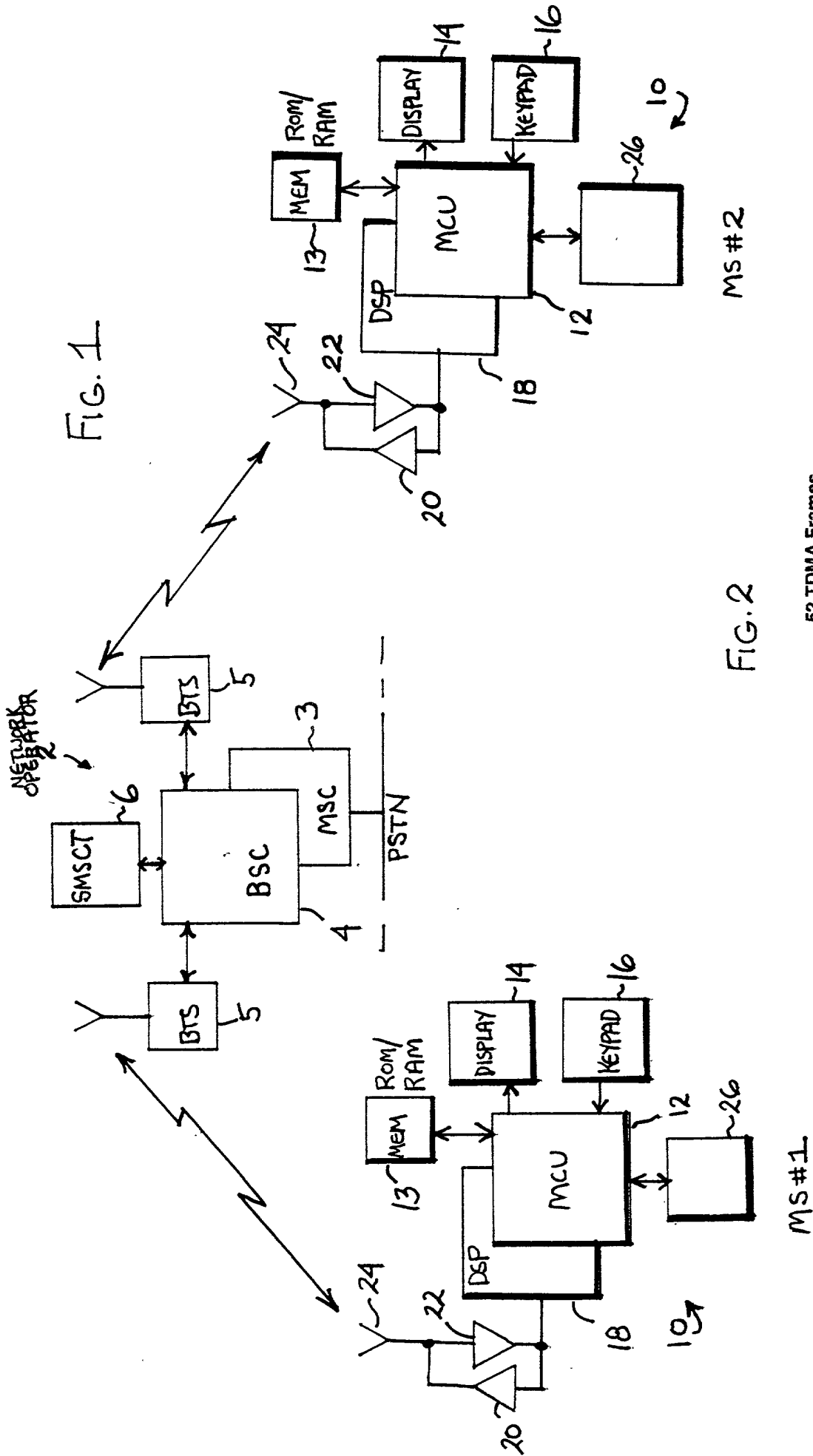


FIG. 2

52 TDMA Frames

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	X
----	----	----	----	----	----	----	----	----	----	-----	-----	---

X = Idle frame

B0 - B11 = Radio blocks

Channel designation	Sub-channel number	Direction	Allowable time-slot assignment	Allowable RF channel assignment	Burst type	Repeat length in TDMA frames	Interleaved block TDMA frame mapping
PDCH, PACCH		D&U	0...7	C0...Cn	NB1	52	B0(0...3), B1(4...7), B2(8...11), B3(13...16), B4(17...20), B5(21...24), B6(26...29), B7(30...33), B8(34...37), B9(39...42), B10(43...46), B11(47...50)
PBCCH		D	0...7	C0...Cn	NB	52	B0(0...3), B3(13...16), B6(26...29), B9(39...42)
PRACH		U	0...7	C0...Cn	AB	52	B0(0)...B11(11), B12(13)...B23(24), B24(26)...B35(37), B36(39)...B47(50)
PPCH, PNCH		D	0...7	C0...Cn	NB	52	B1(4...7), B2(8...11), B3(13...16), B4(17...20), B5(21...24), B6(26...29), B7(30...33), B8(34...37), B9(39...42), B10(43...46), B11(47...50)
PAGCH		D	0...7	C0...Cn	NB	52	B0(0...3), B1(4...7), B2(8...11), B3(13...16), B4(17...20), B5(21...24), B6(26...29), B7(30...33), B8(34...37), B9(39...42), B10(43...46), B11(47...50)
PTCCH/D		D	0...7	C0...Cn	NB	416	B0(12,38,64,90), B1(116,142,168,194), B2(220,246,272,298), B3(324,350,376,402)
PTCCH/U	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	U	0...7	C0...Cn	AB	416	B0(12) B0(38) B0(64) B0(90) B0(116) B0(142) B0(168) B0(194) B0(220) B0(246) B0(272) B0(298) B0(324) B0(350) B0(376) B0(402)

FIG. 3 Mapping of logical channels onto physical channels